UNITED NATIONS

Framework Convention on Climate Change

Distr.
GENERAL

FCCC/SBSTA/1996/7/Add.2
22 February 1996

ENGLISH ONLY

SUBSIDIARY BODY FOR SCIENTIFIC AND TECHNOLOGICAL ADVICE
Second session
Geneva, 27 February - 4 March 1996
Item 4 (a) of the provisional agenda

SCIENTIFIC ASSESSMENTS

CONSIDERATION OF THE SECOND ASSESSMENT REPORT OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE

Addendum

SCIENTIFIC-TECHNICAL ANALYSES OF IMPACTS, ADAPTATIONS, AND MITIGATION OF CLIMATE CHANGE: CONTRIBUTION OF WORKING GROUP II OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE

Note by the secretariat

CONTENTS

		Paragraphs	Page
I.	INTRODUCTION	1 - 4	2
II.	HIGHLIGHTS OF THE REPORT	5 - 11	3
III.	RELATIONSHIP BETWEEN THE WORKING GROUP II REPORT AND THE UNFCCC PROCESS	12	5
	Annex		
	IPCC Working Group II: Tables of contents of the Technical Summary and supporting chapters		6

I. INTRODUCTION

1. Working Group II (WG II) on Impacts, Adaptations, and Mitigation of Climate Change of the Intergovernmental Panel on Climate Change (IPCC) was established to assess the current state of knowledge concerning the impacts of climate change on physical and ecological systems, human health, and socio-economic sectors. Working Group II was also asked to review available information on the technical and economic feasibility of a range of potential adaptation and mitigation strategies.

2. The Second Assessment Report of WG II builds on the prior efforts of the IPCC as reported in the IPCC First Assessment Report (1990) and in Climate Change 1992, the Supplementary Report to the IPCC Scientific Assessment. It is a comprehensive assessment of the impacts of climate change as well as mitigation and adaptation strategies. It is one of four volumes that make up the IPCC Second Assessment Report and comprises thirty-two papers, as follows:

- Summary for Policymakers
- Technical Summary
- Two primers on energy and ecosystems
- Eighteen chapters on impacts and adaptation measures
- Seven chapters on mitigation options
- Technical guidelines for assessing climate change impacts and adaptations
- Methods for assessment of mitigation options
- Inventory of technologies, methods, and practices for reducing emissions of greenhouse gases

The annex to this addendum contains a table of contents for each chapter and a brief description of the contents.

3. The report was prepared by teams of scientific experts, including a convening lead author and contributing authors. Executive summaries, representing the views of the convening and other authors, also form part of the chapters on impacts, adaptation, and mitigation options. It was thoroughly reviewed by scientific and technical experts and Governments.

4. The purpose of this addendum is to describe the contents of the WG II report and to indicate some of the links to the United Nations Framework Convention on Climate Change (UNFCCC). As noted in paragraph 19 of the main note by the secretariat (see document FCCC/SBSTA/1996/7), this addendum is not intended to provide an interpretation of the findings or to serve as a replacement for the IPCC text.

II. HIGHLIGHTS OF THE REPORT

5. As the WG II report contains over 800 pages excluding appendices, a complete review of the material is a formidable task. Consequently, Parties may wish to consider the report in several different ways, depending on their interests and the time available, as suggested below:

(a) Summary for Policymakers. This is the only material that was approved by Governments at the eleventh plenary session of the IPCC held at Rome from 11 to 15 December 1995;

(b) Technical Summary. This document provides additional technical information not found in the Summary for Policymakers. It was prepared by the Bureau of WG II and the convening lead authors;

(c) Energy and ecosystem primers. These two volumes are intended to provide a general overview of the current science for new readers. For example, the ecosystem volume (chapter A) provides an introduction to key concepts, including soil and ecological processes and how they are affected by different climatic factors, while the energy volume (chapter B) introduces terms and units and provides an overview of the global energy system and consumption patterns;

(d) Chapters with executive summaries. These summaries, representing the views of the convening and contributing lead authors, identify what is known about different subject areas and indicate whether the authors have a high, medium, and/or low level of confidence in the information provided. Parties interested in a particular subject, but lacking sufficient time to read the entire chapter, may wish to read these executive summaries;

(e) Main chapters. These chapters differ somewhat in style and level of detail, and in a few cases cover similar material. For example, the 18 chapters on impacts cover both sectors and regions, thereby treating similar material from different perspectives. Readers interested in obtaining an integrated picture of agriculture may wish to read primarily chapters 13 and 23, while those mainly interested in water supply and use may wish to read chapters 5, 7, 10 and 14, and those interested in forests may consult chapters 1, 5, 15, and 24;

(f) References. The IPCC report is thoroughly referenced. Readers interested in seeking original data and information may wish to consult the source manuscripts.

6. The WG II report provides scientific, technical, and economic information for use in evaluating whether the projected range of plausible impacts constitutes "dangerous anthropogenic interference with the climate system ..." as referred to in Article 2 of the Convention. It contains information on several topics not treated in the 1990 report, such as effects on human health and impacts on the financial service sector (particularly the insurance

industry), more comprehensive material on other topics such as rangelands, deserts, the cryosphere and non-tidal wetlands, and more specific data on forests, agriculture, coastal systems, oceans, and infrastructure.

7. Adaptation is treated in several ways: for example, adaptation assumptions used to estimate impacts are described and broad strategies for adapting to and coping with climate change are identified (see, for example, chapters 11-16 and 18). However, an inventory of specific adaptation technologies and know-how is not provided.

8. Information on mitigation options has been expanded beyond the material dealt with in the 1990 First Assessment Report, particularly regarding the cost of technologies (for example, in chapters 19 (energy), 21 (transport), and 24 (forests)). In addition, a number of policies that can facilitate the penetration of less greenhouse-intensive technologies are listed and described.

9. High priority research and monitoring topics are included in almost every chapter. The material is intended for consideration by the general scientific community, several national Governments and intergovernmental organizations concerned, and interested institutions.

10. Two chapters and several appendices focus on methodologies. Chapter 26, "Technical guidelines for assessing climate change impacts and adaptations", has been previously issued by the IPCC as a separate document. It is reflected in decision 4/CP.1* whereby the Guidelines were adopted for use by Annex I Parties in preparing their national communications and for use by non-Annex I Parties, as appropriate and to the extent possible, in the fulfilment of their commitments under the Convention. Chapter 27, "Methods for assessment of mitigation options", and its four related appendices concerned with technical methods, resources guide, case studies and mitigation assessment handbook, were primarily designed to meet the analytical needs of developing countries and countries with economies in transition, although other countries may also wish to utilize them. Chapter 27 notes that these countries have unique economic, social, and political conditions and that many of their needs are vastly different from those found in industrialized countries. The chapter and related appendices provide an analytical framework and specific methods for analysing the electric power, transport, agriculture, and forestry sectors.

11. Chapter 28 of the WG II report is an inventory of technologies, methods, and practices to limit emissions of greenhouse gases, which contains information on the performance characteristics and applications, costs, environmental characteristics, and infrastructure requirements of 105 technologies. This inventory is reflected in the initial report prepared by the secretariat on an inventory and assessment of technologies to mitigate and adapt to climate change (FCCC/SBSTA/1996/4).

---

* For decisions adopted by the Conference of the Parties at its first session, see document FCCC/CP/1995/7/Add.1.

III. RELATIONSHIP BETWEEN THE WORKING GROUP II REPORT AND THE UNFCCC PROCESS

12. The relationship between key elements of the WG II report and the Convention are presented in the table below, which attempts to depict complexities of the document in a highly simplified form. It is not designed to reflect every article in the Convention and the decisions by the Conference of the Parties (COP); nevertheless, it may help readers to consider the linkages between the key elements of the report, the current FCCC process, and the future needs of the Parties for information. Issues that Parties may wish to consider relating to the linkages between the WG II report and the UNFCCC process are found in document FCCC/SBSTA/1996/7.

RELATIONSHIP BETWEEN WG II REPORT AND THE UNFCCC PROCESS

IPCC WG II Report	UNFCCC decisions and Articles of the Convention
Chapters 1-18 (impacts and adaptation)	Consideration of Article 2 Decision 13/CP.1
Chapters 19-25 (mitigation options)	Ad Hoc Group on the Berlin Mandate (AGBM) process Decisions 11, 12, 13/CP.1 In-depth review process
Chapters 26 and 27 (guidelines and methodologies)	Guidelines for national communications Decision 4/CP.1
Chapter 28 (inventory of mitigation technologies)	Decision 13/CP.1
Chapters 1-25 (research and monitoring needs)	Consideration of Article 5
All chapters	Consideration of Article 6

Annex

IPCC WORKING GROUP II: TABLES OF CONTENTS OF THE TECHNICAL SUMMARY AND SUPPORTING CHAPTERS

I. SUMMARY FOR POLICYMAKERS

Summary for Policymakers (18 pages)

1. Scope of the assessment
2. Nature of the issue
3. Vulnerability to climate change
4. Options to reduce emissions and enhance sinks of greenhouse gases

II. TECHNICAL SUMMARY

Technical Summary (35 pages)

1. Scope of the assessment
2. The nature of the issue: Projected changes in climate
3. Vulnerability to climate change: impacts and adaptation
4. Options to reduce emissions and enhance sinks of greenhouse gases: Mitigation
5. Technical guidelines for assessing climate change impacts and adaptation
6. Methods for assessing mitigation options and inventory of mitigation technologies

The Technical Summary provides additional technical information not found in the Summary for Policymakers. It was assembled by the Bureau of Working Group II and the convening lead authors and others, taking into account comments received from experts and Governments on both the chapters and the Summary for Policymakers.

III. ECOSYSTEM AND ENERGY PRIMERS

Chapter A. Ecophysiological, ecological, and soil processes in terrestrial ecosystems: Primer on general concepts and relationships (18 pages)

A.1. Introduction
A.2. Climatic driving forces
A.3. Soil processes and properties
A.4. Ecological processes
A.5. Conclusions

This ecosystem primer gives an overview of interactions between soils and living organisms with climatic parameters such as temperature, precipitation, soil water availability, and CO_2 concentration.

Chapter B. Energy primer (18 pages)

B.1. Introduction
B.2. Energy systems
B.3. Energy use, CO_2 emissions, and energy resources
B.4. Energy-related chapters

This energy primer introduces concepts and terms used in the energy-related chapters of the Second Assessment Report. It describes some of the more commonly used energy units and provides an overview of the global energy system and consumption patterns.

IV. IMPACTS AND ADAPTATION

Chapter 1. Climate change impacts on forests (35 pages)

Executive Summary
1.1. Introduction
1.2. Climate and forests
1.3. Forests in a changing climate
1.4. Tropical forests
1.5. Temperate forests
1.6. Boreal frosts
1.7. Research and monitoring needs

This chapter describes the projected impacts of climate change on tropical, temperate, and boreal forests using observations from the past, experimental studies, and simulation models based on current ecophysiological and ecological information.

Chapter 2. Rangelands in a changing climate: Impacts, adaptation and mitigation (28 pages)

Executive Summary
2.1. Introduction: Description of the world's rangeland resources
2.2. Climate variables
2.3. Ecosystem variables
2.4. Issues of scale
2.5. Extreme events
2.6. Boundary changes
2.7. Regional variation
2.8. Modeling rangeland ecosystem response

2.9. Human adaptation
2.10. Mitigation
2.11. Research needs

This chapter describes projected impacts of altered climate regimes on rangeland resources such as grassland, shrublands, savannas, hot and cold deserts, and tundra. It also discusses human adaptation, mitigation options, and research needs.

Chapter 3. Deserts in a changing climate: Impacts (11 pages)

Executive Summary
3.1. Introduction
3.2. Climate and biology
3.3. Ecosystem variables
3.4. Impacts of climate change
3.5. Biogeographical shifts
3.6. Mitigation
3.7. Future needs

This chapter describes deserts and the main processes that dominate extreme desert environments. It also discusses how these processes might be affected by climate change and describes variability in different deserts, as well as exploring the likely impacts on specific areas. The chapter concentrates on the hottest and driest land types and excludes extreme-cold deserts of polar regions.

Chapter 4. Land degradation and desertification (19 pages)

Executive Summary
4.1. Introduction
4.2. Soil erosion: Causes, processes, and predictions
4.3. Salt-affected soils
4.4. Desertification
4.5. Other forms of soil degradation
4.6. Monitoring and research needs

This chapter emphasizes the effects of climatic change on soil erosion, salinization, and desertification and also reviews impacts on other degradation processes capable of being accelerated by climate change.

Chapter 5. Impacts of climate change on mountain regions (23 pages)

Executive Summary
5.1. Mountain characteristics
5.2. Impacts of climate change
5.3. Future research and monitoring needs

This chapter focuses on the impact of climate change on physical, ecological, and socio-economic systems in mountain regions. It describes potential impacts on snow pack and water systems, the mountain ecosystem, and vegetation.

Chapter 6. Non-tidal wetlands (25 pages)

Executive Summary
6.1. Introduction
6.2. Global importance of wetlands
6.3. Sensitivities and impacts
6.4. Response options - Adaptation, conservation, and restoration
6.5. Examples and case studies
6.6. Future research needs

This chapter emphasizes the possible impacts of climate change on the extent, distribution, and function of non-tidal wetlands in the context of natural or anthropogenic stressors. It also describes the importance of different climate variables and the range of factors that determine the sensitivity of individual wetlands. The chapter uses four case studies to illustrate the effects of climate change: the Sahel, northern boreal wetlands, Kalimantan (Indonesia), and the Florida Everglades.

Chapter 7. The cryosphere: Changes and their impacts (25 pages)

Executive Summary
7.1. Introduction
7.2. Is the cryosphere changing?
7.3. How sensitive is the cryosphere to climate change?
7.4. What will be the impact of future climate change on the cryosphere?
7.5. What will be the impact of these cryospheric changes?
7.6. What do we still need to know?

The cryosphere represents all the global snow, ice, and permafrost regions. This chapter assesses the sensitivity of these regions to climate change, the development of each component, and the impact of climate change on the cryosphere. It also describes the changes in the cryosphere that may affect other physical and human systems and identifies critical information needs.

Chapter 8. Oceans (22 pages)

Executive Summary
8.1. Introduction
8.2. Functions of oceans
8.3. Characteristics of oceans and their responses to climate change
8.4. Impacts of climate change on resources and products

8.5. Evaluation of the impacts of climate change
8.6. Multistress factors
8.7. Research and monitoring needs and strategies

This chapter describes the functions and characteristics of oceans in relation to their human uses, their responses to large-scale global climate change, the range of available mitigation and adaptation response options, and research and monitoring needs.

Chapter 9. Coastal zones and small islands (36 pages)

Executive Summary
9.1. Introduction
9.2. Functions and values of coastal zones and small islands
9.3. Aspects of climate change of concern to coastal zones and small islands
9.4. Biogeophysical effects
9.5. Socio-economic impacts
9.6. Response strategies
9.7. Research and monitoring needs

This chapter presents an assessment of the latest scientific information on the impacts of climate change on coastal zones and small islands and on strategies that countries may wish to apply in response to these impacts.

Chapter 10. Hydrology and freshwater ecology (39 pages)

Executive Summary
10.1. Introduction
10.2. The hydrological cycle
10.3. Effects of climate change on the hydrological cycle
10.4. Extreme hydrological events
10.5. Physical and chemical changes in freshwater ecosystems
10.6. Lake and stream biology
10.7. Research needs

The chapter covers four main issues: the potential effects of global warming on components of the hydrological cycle; possible changes in the frequency and magnitude of extreme high and low flows; implications for thermal, chemical, and morphological changes; and consequences for stream and lake ecosystems.

Chapter 11. Industry, energy, and transportation: Impacts and adaptation (34 pages)

Executive Summary
11.1. Introduction
11.2. Characteristics and sensitivities of the sectors
11.3. Overview of the literature

11.4. Economic activity with climate-sensitive markets
11.5. Economic activity sensitive to climate
11.6. Economic activity dependent on climate-sensitive resources
11.7. Need for future assessments

Industrial activities directly sensitive to climate change are described. These include, for example, construction, transportation, offshore oil production, manufacturing depending on water, tourism, and agro-industries.

Chapter 12. Human settlements in a changing climate: Impacts and adaptation (28 pages)

Executive Summary
12.1. Introduction
12.2. Non-climate factors
12.3. Impacts and ranges of sensitivities to climate change
12.4. Extreme events
12.5. Adaptation options
12.6. Needs for future research

This chapter focuses on how climate change and sealevel rise will affect human settlements.

Chapter 13. Agriculture in a changing climate: Impacts and adaptation (41 pages)

Executive Summary
13.1. Introduction
13.2. Climatic effects on crop plants
13.3. Soil changes and agricultural practices
13.4. Weeds, insects, and diseases
13.5. Animal agriculture
13.6. Regional climate impacts: Studies and issues
13.7. Regional summary: Relative vulnerability
13.8. Global agricultural issues and assessments
13.9. Adaptation
13.10. Research needs

The chapter assesses four areas: direct and indirect effects of climate change on crop yields, agricultural pests and livestock; estimates of yield and production changes for specific regions and the world; areas and populations that are relatively more vulnerable; and adaptation potential.

Chapter 14. Water resources management (18 pages)

Executive Summary
14.1. Introduction
14.2. Impact of climate on water supply

14.3. Impact of climate on water demand
14.4. Management implications and adaptation options
14.5. Research needs

This chapter describes the sensitivity of the components of water resource systems to potential climate change. It also indicates how water management strategies may be put into effect to adapt to climate change.

Chapter 15. Wood production under changing climate and land use (24 pages)

Executive Summary
15.1. Introduction
15.2. Present and future global forests
15.3. Evaluation of tropical wood availability and consumption
15.4. Evaluation of temperate wood availability and consumption
15.5. Evaluation of boreal wood availability and consumption
15.6. Adaptation and coping options
15.7. Research needs

The chapter describes the availability of forest resources and the possible changes induced in wood and wood products. It includes estimates of the demand for wood and wood products and describes potential shifts in the productivity and geographic distribution of tree species in boreal, temperate and tropical regions that may alter supplies.

Chapter 16. Fisheries (27 pages)

Executive Summary
16.1. Current status of fisheries
16.2. Climate change impacts
16.3. Adaptation options
16.4. Research and monitoring needs

Potential impacts of climate change on freshwater and saltwater fisheries, aquaculture, health and infrastructural issues, and recreational fisheries are discussed in this chapter.

Chapter 17. Financial services (22 pages)

Executive Summary
17.1. Introduction
17.2. Financial services
17.3. The property insurance market
17.4. Extreme events and property insurance
17.5. Impact of extreme events on property insurance
17.6. Adaptation to climate change by property insurers

17.7. Impacts and adaptation in other financial services
17.8. Implications for Policymakers
17.9. Requirements for future assessments

This chapter provides a brief overview of financial services with particular emphasis on the property insurance sector. It describes the important impact that extreme climatic events can have on this sector and the techniques used by property insurers to adapt to changes in risk.

Chapter 18. Human population health (24 pages)

Executive Summary
18.1 Introduction
18.2. Potential direct health impacts of climate change
18.3. Potential indirect health impacts of climate change
18.4. Stratospheric ozone depletion and ultraviolet radiation: Impacts on health
18.5. Options for adaptation
18.6. Research needs
18.7. Concluding remarks

An assessment is provided of the potential direct health effects due to high temperature events and indirect effects from changes in air pollutants and food production. It also describes potential shifts in vector-borne diseases, such as malaria, and non-vector-borne diseases, such as cholera. Adaptation options and monitoring strategies are also provided.

V. MITIGATION OPTIONS

Chapter 19. Energy supply mitigation options (61 pages)

Executive Summary
19.1. Introduction
19.2. Options to reduce greenhouse gas emissions
19.3. Low CO_2-emitting energy supply systems for the world
19.4. Implementation issues

This chapter focuses on emerging energy technologies that can reduce greenhouse gas emissions and identifies advances in technologies such as gas turbines, coal and biomass gasification, use of biomass for transportation, wind, photovoltaics, fuel cells, nuclear, carbon sequestration, and hydrogen. It provides a series of "thought experiments" or "low CO_2-emitting energy supply systems" (LESS) scenarios, which outline how the global energy system could change at low cost.

Chapter 20. Industry (29 pages)

Executive Summary
20.1. Introduction
20.2. Industrial-sector emissions of greenhouse gases
20.3. Specific industry emissions
20.4. Technical abatement options
20.5. Policy options
20.6. Conclusions

This chapter outlines the major sources and trends of greenhouse gas emissions from industrial activity. It indicates possible abatement strategies including technologies, processes, and product designs to lower CO_2 emissions in the future.

Chapter 21. Mitigation options in the transportation sector (34 pages)

Executive Summary
21.1. Introduction
21.2. Transport and greenhouse gas emissions
21.3. Reducing transport greenhouse gas emissions
21.4. Transport-policy perspective on greenhouse gas emissions

This chapter addresses options for mitigation of greenhouse gas emissions in the transport sector, including travel and freight movements by road, rail, air, and water. Current emissions from transport and their trends, the contribution of non-CO_2 greenhouse gases and the patterns of different countries and regions are analysed. The potential for emission reductions through changes in vehicle maintenance and new vehicle design, changes in vehicle operating practice, and introduction of alternative fuels are reviewed. Effects of fiscal, regulatory, planning, and other measures in the transport sector are discussed.

Chapter 22. Mitigation options for human settlements (31 pages)

Executive Summary
22.1. Introduction
22.2. Historic trends in greenhouse gas (GHG) emissions from human settlements
22.3. Factors affecting future growth of GHG emissions from human settlements
22.4. Potential for reducing GHG emissions
22.5. Policy options
22.6. Scenarios

The chapter reviews estimates of greenhouse gas emissions and trends from human settlements, describes key factors that affect the growth of these emissions, and assesses technical and economic potentials for reducing the emissions. Policy measures at the local, national, and international levels are also reviewed.

Chapter 23. Agricultural options for mitigation of greenhouse gas emissions (27 pages)

Executive Summary
23.1. Introduction
23.2. Carbon dioxide
23.3. Methane and nitrous oxide
23.4. Economic feasibility of mitigation options
23.5. Uncertainties and future research needs

This chapter provides information on greenhouse gas emissions and trends in the agriculture sector. It describes how emissions could be reduced through better management practices relating, for example, to fertilizer usage, better nutrition of ruminant animals, water management in rice paddies, and waste treatment systems.

Chapter 24. Management of forests for mitigation of greenhouse gas emissions (25 pages)

Executive Summary
24.1. Introduction
24.2. Role of forests in the global carbon cycle
24.3. Carbon mitigation options
24.4. Assessment of carbon mitigation options
24.5. Projected costs and benefits of carbon conservation and sequestration
24.6. Impacts of future climate, atmospheric CO_2, land use, and human population on carbon conservation and sequestration
24.7. Research and data needs

The chapter reviews forest management practices, including information on their cost, that can be used to conserve and sequester carbon. These practices include, for example, protection, afforestation, intermediate silvicultural treatments, harvesting, and agroforestry.

Chapter 25. Mitigation: Cross-sectoral and other issues (21 pages)

Executive Summary
25.1. Introduction
25.2. Energy implications for low-emissions greenhouse gas scenarios
25.3. Issues related to land use and land cover
25.4. Concepts for counterbalancing climatic change
25.5. Integrated assessment of mitigation potential

This chapter describes some of the cross-cutting issues likely to affect the adaptation and mitigation options presented in the previous chapters. The focus is on land use issues, geo-engineering and energy efficiency.

VI. GUIDELINES

Chapter 26. Technical guidelines for assessing climate change impacts and adaptations (11 pages)

Executive Summary
26.1. Objectives
26.2. Approaches
26.3. Step One - Definition of the problem
26.4. Step Two - Selection of the method
26.5. Step Three - Testing the method
26.6. Step Four - Selecting of the scenarios
26.7. Step Five - Assessment of impacts
26.8. Steps Six and Seven - Assessment of autonomous adjustments and evaluation of adaptation strategies
26.9. Obtaining a copy of the guidelines

This chapter was published as a part of the IPCC Special Report (1994). It provides a review of the methods to assess climate change impacts and adaptation options and is intended for the technical analyst responsible for organizing and undertaking impact assessments.

Chapter 27. Methods for assessment of mitigation options (9 pages)

27.1. Introduction
27.2. Challenges in a mitigation options assessment
27.3. Analytical framework and levels of decision-making
27.4. Organizing a mitigation options assessment
27.5. Key methodological issues
27.6. Analytical methods
27.7. Conclusions
27.8. Obtaining a copy of the guidelines

This chapter and the four related appendices provide a review of methods for assessing mitigation options in the energy, transport, forestry, and agriculture sectors. The documents provide a framework for analysis, a resources guide, information on specific models, case studies, and a handbook for analysts. The methods were reviewed at four workshops in Denmark, Poland, Thailand, and the United States of America.

Appendix I: Technical methods

This volume is a catalogue of analytical methods, describing in detail their purpose, appropriate application, potential drawbacks, and references for further information. The methodology includes cross-sectoral, sectoral and programme analyses.

Appendix II: Resources guide

This volume is a reference guide for readers interested in databases and analytical models, sources, institutional contacts, and programme information.

Appendix III: Case studies

This volume contains a set of case studies of methods and approaches used by a small set of developing countries and countries with economies in transition.

Appendix IV: Mitigation assessment handbook

This handbook provides a description of how to use a limited set of basic models.

Chapter 28. Inventory of technologies, methods and practices (7 pages)

28.1. Introduction
28.2. Emission reduction technologies
28.3. Other technology inventories
28.4. Obtaining a copy of the inventory

This chapter is an introduction to the "Inventory of technologies, methods and practices for reducing emissions of greenhouse gases" which is being issued as an appendix.

Appendix I. Inventory of technologies, methods and practices for reducing emissions of greenhouse gases (232 pages)

The inventory is a database containing information on technologies, methods and practices to limit emissions of greenhouse gases in the energy, transportation, building, industry and agriculture sectors. The inventory contains information on performance characteristics and applications, capital and operating costs, environmental characteristics (including emissions of greenhouse gases), and infrastructural requirements.

- - - - -

UNITED NATIONS

Framework Convention on Climate Change

Distr.
GENERAL

FCCC/SBSTA/1996/7/Add.3
22 February 1996

ENGLISH ONLY

SUBSIDIARY BODY FOR SCIENTIFIC AND TECHNOLOGICAL ADVICE
Second session
Geneva, 27 February - 4 March 1996
Item 4 (a) of the provisional agenda

SCIENTIFIC ASSESSMENTS

CONSIDERATION OF THE SECOND ASSESSMENT REPORT OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE

Addendum

THE ECONOMIC AND SOCIAL DIMENSIONS OF CLIMATE CHANGE: CONTRIBUTION OF WORKING GROUP III OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE

Note by the secretariat

CONTENTS

		Paragraphs	Page
I.	INTRODUCTION	1 - 5	2
II.	OBSERVATIONS	6 - 9	3
	Annex		
	IPCC Working Group III: Tables of contents of the supporting chapters		4

I. INTRODUCTION

1. Working Group III (WG III) of the Intergovernmental Panel on Climate Change (IPCC) was restructured in 1992 and charged with conducting technical assessments of the socio-economic dimensions of impacts, adaptation and mitigation of climate change over both the short and the long term at the regional and global levels. Its work programme, approved by the IPCC in June 1993, consisted of two parts:

(a) An evaluation of emission scenarios to be completed in time for the 1994 Special Report of the IPCC; and

(b) An assessment of the literature on socio-economic issues related to climate change for the IPCC Second Assessment Report.

2. The mandate of WG III as given by the IPCC included the following:

> It will place the socio-economic perspectives of climate change in the context of sustainable development. In particular, and in accordance with the United Nations Framework Convention on Climate Change (UNFCCC), the work of the WG III will be comprehensive, cover all relevant sources, sinks and reservoirs of greenhouse gases and adaptation, and comprise all economic sectors.

3. The Working Group was enjoined to assess available literature in these fields. It should give due recognition in its work to the Rio Declaration on Environment and Development, Agenda 21 and, in particular, the UNFCCC. It should not make policy judgements.

4. The writing teams were composed of economists and, to a lesser extent, social scientists and other experts. Each team included at least one expert from a developing country.

5. WG III sponsored workshops in Brazil, Italy, Japan and Kenya; each of these had a topical and regional component. WG III also contributed to the IPCC workshop on Article 2 of the UNFCCC, held at Fortaleza, Brazil, in October 1994. The proceedings of the following workshops have been published:

- Policy Instruments and their Implications/Asia and the Pacific (Tsukuba, Japan, 13 to 20 January 1994)

- Equity and Social Considerations/Africa (Nairobi, Kenya, 18 to 22 July 1994)

II. OBSERVATIONS

6. The contribution of WG III to the Second Assessment Report consists of a Summary for Policymakers and 11 supporting chapters. Its report assesses a large part of the existing literature on the socio-economic issues related to climate change and identifies areas in which a consensus has emerged on key issues and areas where differences exist. According to the Summary for Policymakers, the chapters (see annex to the present note) have been arranged so that they cover several key issues; the order of the chapters, however, does not fully correspond to the order of the issues:

(a) First, frameworks for **socio-economic assessments of costs and benefits** of action and inaction are described. Particular attention is given to the applicability of cost-benefit analysis, the incorporation of equity and social considerations, and consideration of intergenerational equity issues (chapters 1, 2, 3, 4, 5 and 10);

(b) Second, the economic and social **benefits** of limiting greenhouse gas emissions and enhancing sinks are reviewed (chapter 6);

(c) Third, the economic, social and environmental **costs** of mitigating greenhouse gases are assessed (chapters 8 and 9);

(d) Fourth, generic **mitigation and adaptation response options** are assessed and the costs and effectiveness of different response options are summarized (chapter 7);

(e) Finally, the report provides an **economic assessment of policy instruments** to combat climate change (chapter 11).

7. The assessment of the literature on the socio-economic issues related to climate change focuses on the economic literature; material from other social sciences will be found mostly in chapter 3 on equity and social considerations.

8. The literature on socio-economic aspects of climate change is in several areas very controversial. Value judgements and policy preferences may largely determine which scientific approaches will be followed or rejected. In this regard, WG III notes that it provides an assessment of the current state of knowledge -- what we know and do not know -- and not a prescription for policy consideration.

9. Issues that Parties may consider in relation to the WG III report are given in document FCCC/SBSTA/1996/7.

Annex

IPCC WORKING GROUP III: TABLES OF CONTENTS OF THE SUPPORTING CHAPTERS*

Chapter 1. Introduction: Scope of the assessment (73 pages)

Summary
1.1 Introduction
1.2 Features of the climate change
1.3 Contribution of economics
1.4 Equity
1.5 Economics of policy actions
1.6 Sustainable development
Endnotes
References

This chapter is an introduction to the contribution of Working Group III to the Second Assessment Report. It describes the general characteristics of climate change, the possible contributions of economics in addressing the problem, and general issues such as equity, the economics of policy actions, and sustainable development.

Chapter 2. Decision-making frameworks for addressing climate change (32 pages)

Summary
2.1 Introduction
2.2 The context for climate change decision-making
2.3 Quantitative models of decision-making
2.4 Implications for national decision-making frameworks under the UNFCCC
Endnotes
References

This chapter discusses possible decision-making frameworks related to climate change. It describes and reviews the theoretical literature concerning decision-making, indicating how different frameworks can lead to different conclusions. It outlines several different frameworks such as global optimization, sequential decision-making, the decision-making process (how decisions are made), and collective decision-making (a framework for negotiating decisions).

---

* Titles of chapters and subheadings are listed as given in the IPCC Second Assessment Report.

Chapter 3. Equity and social considerations (99 pages)

Summary
3.1 Introduction
3.2 Equity in international law and in the UNFCCC
3.3 Principal differences among regions and countries
3.4 Distributing the costs of coping: Impacts, risks and international insurance
3.5 Distributing future emissions and abatement costs
3.6 Equity within countries
3.7 Procedural fairness in international climate change processes
3.8 Conclusions
Endnotes
References

The chapter begins by reviewing concepts of equity and issues that must be considered in efforts to apply these concepts. It then looks at these broad concepts within the tradition of international law and the specific context of the UNFCCC and considers several ways in which this text assigns specific meaning to equity. It also analyses in detail several specific aspects of equity: international equity in coping with the impacts of climate change and associated risks, international equity in efforts to limit climate change, equity and social considerations within countries, and equity in international processes.

Chapter 4. Intertemporal equity, discounting, and economic efficiency (39 pages)

Summary
4.1 Introduction
4.2 Building blocks of the analytical approach
4.3 Perspective approach
4.4 Descriptive approach
4.5 Conclusion: Reconciling the two approaches
Endnotes
References

This chapter considers methods for comparing costs and benefits that arise at different times, especially where trade-offs occur across generations, and how these trade-offs involve issues of intertemporal equity. The topic raises questions of ethics and morals, because it involves reaching judgements about what is fair or just, and also of economics, because comparisons across time are necessarily judged in the light of changing standards of living over time, opportunities for productive investment, and trade-offs across generations.

Chapter 5. Applicability of techniques of cost-benefit analysis to climate change (47 pages)

Summary
5.1 Introduction

5.2 Cost-benefit analysis
5.3 Unique features of climate change
5.4 Cost-benefit analysis in the context of climate change
5.5 Issues
5.6 Conclusion
Endnotes
References

The objective of this chapter is to examine how and under what circumstances cost-benefit analysis can make a contribution to the resolution of the central questions now facing decision-makers about global climate change and the reduction of emissions. After cost-benefit analysis has been defined and put into the context of the unique features of climate change, key issues such as risk uncertainty, irreversibility, valuation, discounting, equity and multiple criteria are discussed.

Chapter 6. The social costs of climate change: Greenhouse damage and the benefits of control (92 pages)

Summary
6.1 Conceptual framework
6.2 Damage estimates for benchmark warming (2 x CO_2)
6.3 Damage estimates for longer-term warming
6.4 Climate catastrophes and surprises
6.5 Regional implications of climate change
6.6 From greenhouse damages to abatement benefits
6.7 The secondary benefits of abatement strategies
6.8 Conclusions
Endnotes
References

This chapter deals with the nature of damages caused by climate change. Damages here refer to the consequences of climate change for individuals and social welfare from an economics point of view. The chapter assesses the possible aggregate scale, the geographic distribution, and the nature of those damages. It raises certain issues relating to decision-making rules, since alternative ethical approaches to harm done to future generations have implications for damage assessment.

Chapter 7. A generic assessment of response options (59 pages)

Summary
7.1 Introduction
7.2 A contextual framework
7.3 Criteria for assessment
7.4 Mitigation options
7.5 Adaptation options

7.6 An integrated approach
7.7 Regional differences and international cooperation
Endnotes
References

This chapter surveys the set of response options feasible from an economic perspective in order to assess the scope and priorities of policies. Mitigation and adaptation options are reviewed in terms of applicability, cost-effectiveness, and social acceptability. The scope for integrated response options is evaluated and an analysis is presented of the extent to which various options may provide a basis for international policy cooperation.

Chapter 8. Estimating the cost of mitigating greenhouse gases (52 pages)

Summary
8.0 Introduction
8.1 Costs: Definition and determinants
8.2 Patterns of development and technological change
8.3 Differences among models and their results
Endnotes
References

This chapter presents a discussion of the critical determinants likely to influence the overall cost of climate policies and of the main methodologies employed to arrive at them. It examines the various concepts of costs used in the literature; the relationship between cost assessment and assumptions about development patterns and technical change that underlie any economic scenario used to assess mitigation costs. It also reviews the main methodological approaches for costing assessment, the key assumptions likely to determine the numerical result and the lessons derived from modelling debates in the energy field and in the forestry sector.

Chapter 9. A review of mitigation cost studies (119 pages)

Summary
9.1 Introduction
9.2 Review of existing studies of the costs of reducing CO_2 emissions
9.3 Studies of the costs of carbon sequestration
9.4 Studies of the costs of reducing non-energy GHG emissions
Endnotes
References

This chapter reviews, compares, and summarizes numerous recent studies of the costs of reducing greenhouse gas emissions and carbon sequestration.

Chapter 10. Integrated assessment of climate change: An overview and comparison of approaches and results (37 pages)

Summary
10.1 Introduction
10.2 Approaches to integrated assessment
10.3 Elements of an integrated assessment model
10.4 Overview of existing integrated assessment models
10.5 First results from integrated assessment models
10.6 Strengths and limitations of current integrated assessments
Endnotes
References

After defining integrated assessment and its purposes, the chapter discusses the different approaches to it. Elements of models for integrated assessment, the first results of these models and the challenges faced by them are reviewed.

Chapter 11. An economic assessment of policy instruments to combat climate change (72 pages)

Summary
11.1 Introduction
11.2 Greenhouse policy instruments and criteria for policy assessment
11.3 The domestic policy context
11.4 Regulations, voluntary agreements and other non-market based instruments
11.5 Market-based policy instruments
11.6 Policy implementation issues
11.7 Comparative assessment of greenhouse policy instruments
Endnotes
References

The aim of this chapter is to provide an economic assessment of possible policy instruments to manage greenhouse gas emissions. The factors affecting the policy mix for control of greenhouse gas emissions are reviewed, using guiding principles and taking into account the general international legal framework in which the Convention must operate.

- - - - -